

### CS/MCS 401, Homework 3 ,Lowman, Summer 2016

Due in class Wednesday 7/6/16. Late homework will not be accepted.

Note, no class Monday 7/4/16.

In all problems work must be shown to explain your answers.

1. Use the definition of a binomial random variable  $X$  and the definition of the expected value  $E[X] = \sum_{all\ x} x \cdot P(x)$  to prove  $E[X] = np$ . Do not use indicator random variables.
2. Given  $X$  is a binomial random variable, use indicator random variables to prove  $E[X] = np$ .
3. Exercise 5.2-3 page 122. Indicator RVs.
4. Exercises page 37: 2.3-1, 2.3-2, 2.3-3, 2.3-6
5. Problems page 41: 2-4(a,b,c)
6. Find the best-case and worst-case time for the Bubble-Sort and Better-Bubble-Sort algorithms given in class slides. The slides are posted on Piazza Include the algorithms with your work.
7. Find the best-case, worst-case and average-case running times for Insertion-Sort. Show all work and explain any assumptions that you use. Include the algorithm with your work
8. Prove that  $\lfloor -x \rfloor = -\lceil x \rceil$  and that  $\lceil -x \rceil = -\lfloor x \rfloor$
9. Exercises page 173: 7.1-1, 7.1-2, 7.1-3, 7.1-4
10. Problems page 187: 7-3 a,b,c,d,e
11. Find a BigOh for Quicksort for the following three cases:
  - (a) sort a pre-sorted array
  - (b) sort a pre-reverse-sorted array
  - (c) sort an array with all equal elements
  - (d) the recursive calls to quicksort alternate good case, bad-case, good case, bad case, ... . Under what conditions could this possibly happen?